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Traditional Forensic Examinations on Bulk Special Nuclear Material

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The Federal Bureau of Investigation (FBI) Laboratory at Quantico, Virginia is responsible for the forensic examination of radiological evidence and evidence contaminated with radioactive materials. Due to these unique hazards and the necessary specialized safety protocols, the FBI has developed a network of Partner Laboratories (PLs) across the United States of America to support conventional forensic examinations of radiological evidence and evidence contaminated with radioactive materials. In support of this, the FBI Laboratory has established the Hazardous Evidence Analysis Team (HEAT), a group of qualified forensic examiners, scientists, technicians, and photographers who can deploy to laboratories outside of the FBI Laboratory at Quantico, VA to perform conventional forensics on evidence containing/contaminated with hazardous materials.

One of the FBI's PLs, the United States Department of Energy's Los Alamos National Laboratory (LANL), in Los Alamos, New Mexico, has unique facilities, personnel, and procedures to secure, safely handle, and process significant quantities of special nuclear material (SNM). While LANL's procedures for working with SNM are well established, working with SNM under evidentiary controls is not. Close cooperation between LANL and FBI HEAT is required due to FBI policies on evidence handling, as well as the challenges associated with the exploitation and preservation of conventional forensics (fingerprints, trace evidence, and photography) on SNM evidence.

Hazardous Evidence Analysis Team Capability at LANL

For FBI HEAT members to be deployed to LANL, they must meet all of the requirements for the HEAT program, as well as site-specific requirements. For LANL, site-specific requirements include radiological worker training (16 hours of in-person training), respirator training (1 hour of in-person training), medical clearance to use the respirator, and completion of other health and safety training courses (approximately 5 hours of online training). Due to the unique safety and security concerns, even after completion of all the site-specific training, FBI personnel are not able to handle SNM and must rely on experts at LANL for the physical manipulation of SNM. Throughout the planning and execution of a HEAT deployment to LANL, the FBI receives guidance and assistance from LANL's team of experts, including radiation safety specialists, environmental health and safety specialists, and SNM handlers. During a HEAT deployment to LANL, SNM handlers work side-by-side with FBI HEAT personnel, with additional oversight and guidance from the environmental health and safety and radiation safety experts. The training and guidance provided by LANL allows FBI HEAT personnel to conduct conventional forensic examinations on SNM to the same standards as required in the FBI Laboratory at Quantico without any unnecessary safety risks.

Annual exercises are conducted at LANL to allow FBI HEAT personnel the opportunity to work with LANL experts for training, practice, method development, and process

improvement. For the most recent exercise, the evidence being examined was a training aid that did not contain SNM and the work was conducted in a radioactive-material free practice area. However, the conduct of the exercise was performed under the SNM LANL safety and surety protocols for working with SNM. The objectives were to exercise bringing FBI owned equipment and chemicals into LANL space and conduct conventional forensic exams. Cameras require a review and approval process due to the controlled nature of LANL space, latent print processing chemicals require approval by LANL's chemical safety experts, and other electronics (alternate light sources, laser pointers, and the necessary batteries) require approvals by LANL safety experts.

The FBI worked with LANL to design a tent (Figure 1) to house the HEAT forensic examinations. This provides a working environment that is free from any existing contamination from prior work and prevents the evidence from contaminating LANL's workspace. The tent is designed specifically for conventional forensic exams of SNM - there is an air handling system for proper ventilation, pass-throughs for providing power to necessary equipment, and windows with coverings to control the lighting within the tent for alternate light source exams. Following each exercise, the FBI and LANL have discussions to determine if any changes should be made to the plans for future tents.

To further mitigate the hazards of SNM and decrease the likelihood of contamination being spread, disposable glove bags are used to contain the evidence within the tent. The glove bags are fabricated by LANL to FBI specifications and the standards required by LANL for use inside of a Category II nuclear facility. The glove bag allows for the SNM evidence to be manipulated without risking contamination of LANL SNM handlers or FBI examiners. Per FBI design specifications, there are quartz windows on the glove bag to allow for photography without any distortion being introduced by the glove bag material. The disposable nature of the glove bag and tent ensures that there is never any risk of a current exam being contaminated by previous work. In cases where higher hazards are present, the work practices used with the glove bags can be mirrored while using LANL's glove boxes. There is no additional training burden on FBI staff if the decision is made to use the glove boxes, since LANL SNM handlers are performing the manipulations.

Recent HEAT Exercise at LANL

As part of the FBI Laboratory's agreement with LANL and for method development, process improvement, and training, HEAT conducts regular exercises on-site. In 2020, the FBI Laboratory deployed a team composed of latent prints, trace evidence, and photography subject matter experts to LANL for an exercise. This exercise's focus was to conduct traditional forensic examinations on a large object composed of simulated uranium. The specifics of this meant that while the injected dose/dose rate was not a hazard, there were considerations regarding risks for contamination and the security and surety of the simulated uranium object.

The tent and glove bag were assembled at LANL, and the uranium object was transferred into the glove bag with the help of LANL's radiological safety and SNM handlers. Once the item was in the glove bag, LANL SNM handlers physically manipulated the object during exams,

following the directions of the FBI forensic examiners. After initial visual examinations and photography, the lighting inside the tent was temporarily adjusted to allow for the use of alternate light sources by latent print examiners (Figure 3). Next, trace evidence examiners collected and preserved any hairs and fibers that were on the items. Finally, latent print examiners used chemical processing to obtain any additional prints on the pieces of the evidence (Figure 4). Throughout the entire process, LANL SNM handlers manipulated the object to facilitate the best possible orientation for examinations and photography.

Ultimately, the exercise showed how FBI HEAT, working within the facilities of LANL and with the support of the experts at LANL, is capable of handling and conducting conventional forensic examinations on a bulky nuclear material. Trace evidence and latent prints on the object and associated items were collected and preserved, with photographic support throughout all examinations. FBI latent print examiners were able to develop prints that had the necessary quality to allow for searching in fingerprint databases. Furthermore, all examinations were done in a manner consistent with the practices and procedures of the FBI and would be defensible in a court of law.

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Figure 1: Viewing windows and air handling system of the tent.

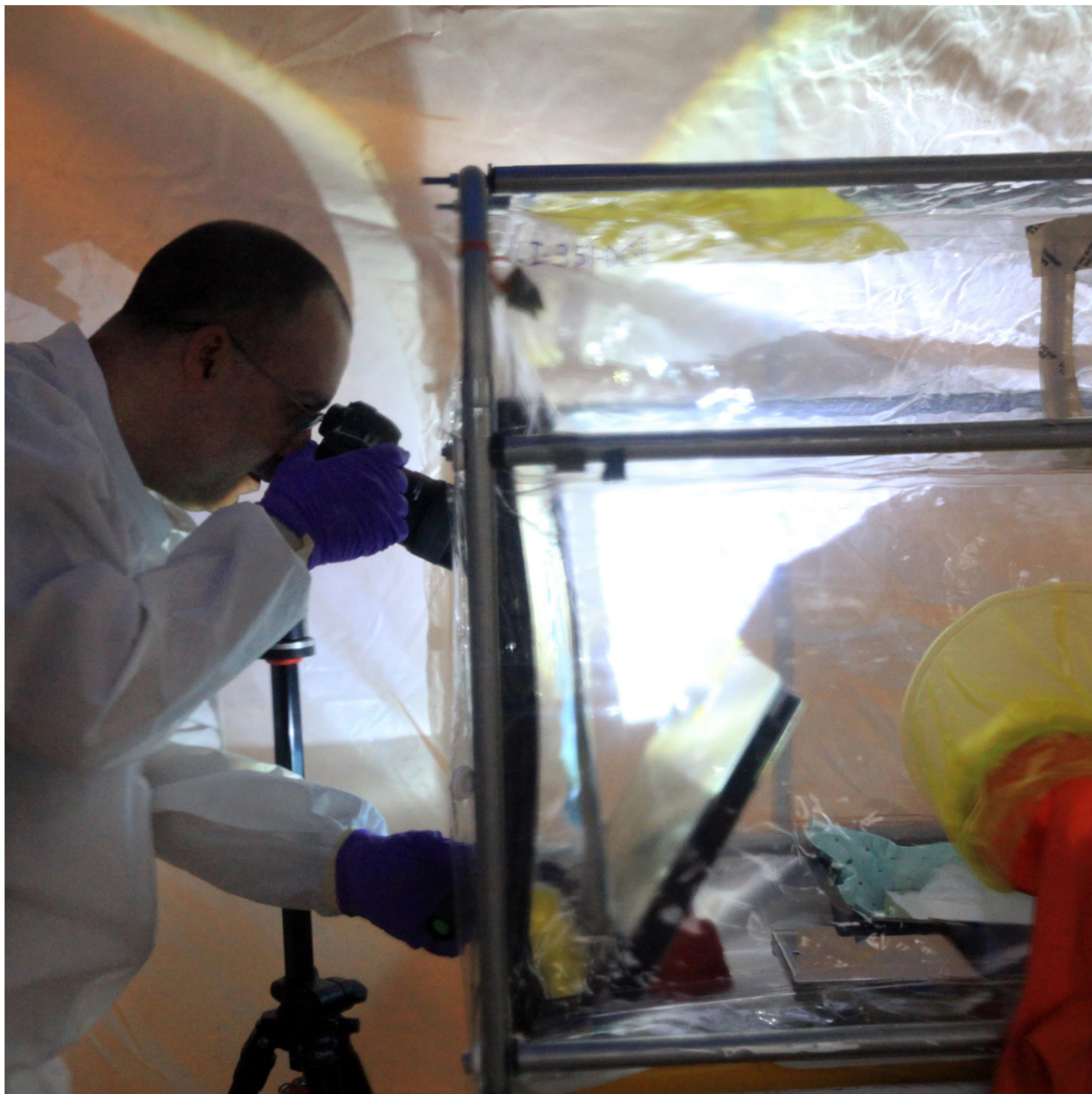


Figure 2: FBI HEAT Photographer using the quartz window to photograph evidence inside the glove bag.



Figure 3. Alternate light sources being used for latent print examinations on evidence in the glove bag.

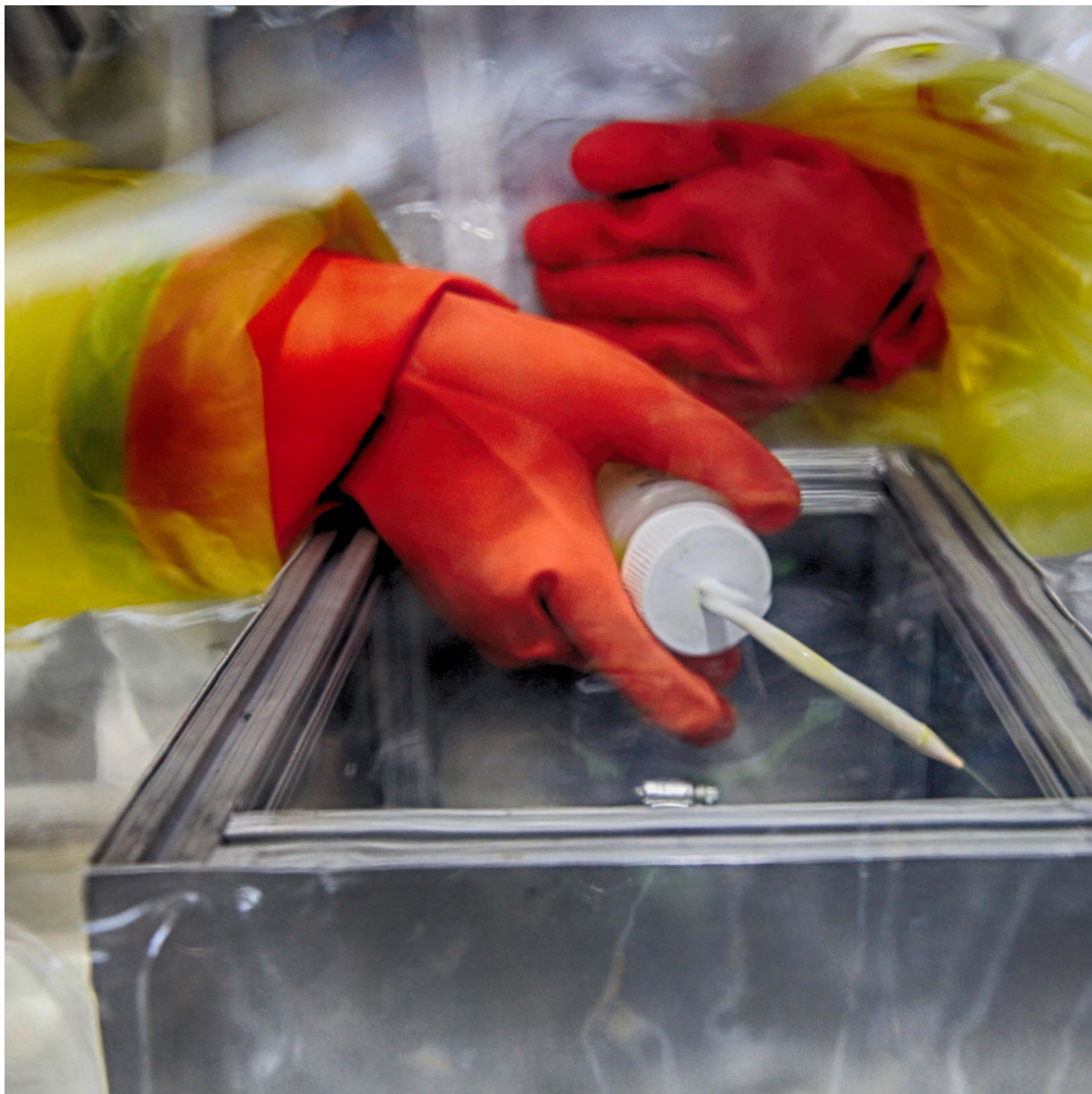


Figure 4. Chemical processing of the simulated uranium object to develop possible latent fingerprints.